TFT LCD Preliminary Specification

MODEL NO.: M240J1- L03

Customer: _____

Approved by: _____

Note: Preliminary spec. for reference only!

Liquid Crystal Display Division	
QRA Division	OA Head Division
Approval	Approval
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- CONTENTS -

REVISION HISTORY

Version	Date	Section	Description
Ver 1.0	May 04, 06'	-	M240J1 -L03 preliminary specifications was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

M240J1-L03 is an 24.0" TFT Liquid Crystal Display module with 6 CCFL Backlight unit and 30 pins 2ch-LVDS interface. This module supports 1920 x 1200 WUXGA mode and can display up to 16.7M colors. The inverter module for Backlight is built in.

1.2 FEATURES

- Super MVA extra-wide viewing angle.
- High contrast ratio.
- Fast response time.
- High color saturation.
- WUXGA (1920 x 1200 pixels) resolution.
- DE (Data Enable) only mode.
- LVDS (Low Voltage Differential Signaling) interface.
- RoHS compliance.
- TCO'03 compliance.
- Flash function support by the inverter module that built in the Backlight unit.

1.3 APPLICATION

- TFT LCD Monitor

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	518.4 (H) x 324 (V) (24.0" diagonal)	mm	(1)
Bezel Opening Area	522.4 (H) x 328.0 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1200	pixel	-
Pixel Pitch	0.270 (H) x 0.270 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7M	color	-
Transmissive Mode	Normally black	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	545.9	546.4	546.9	mm	(1)
	Vertical(V)	351.5	352.0	352.5	mm	
	Depth(D)		35.36	35.86	mm	
Weight		-	-	2800	g	-

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	50	G	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

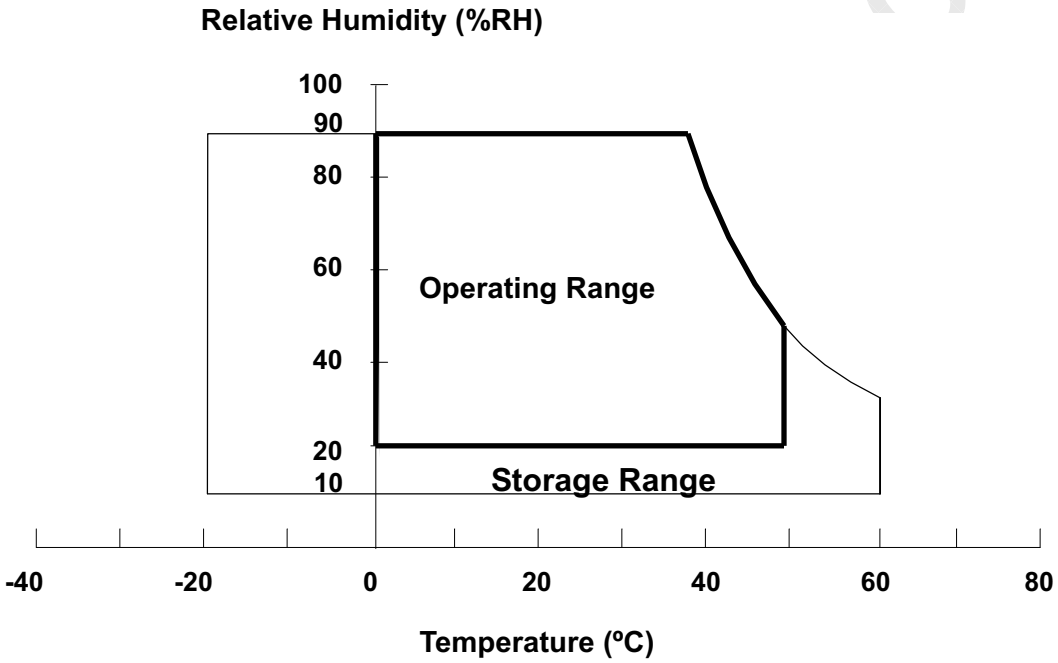
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.

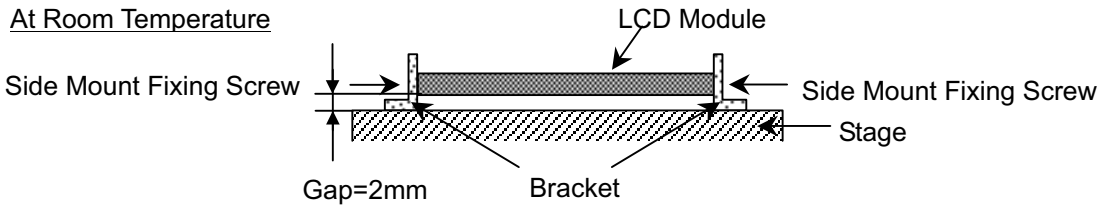


Note (3) 11ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 300 Hz, 10min/cycle, 3 cycles each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:



2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	Vcc	-0.3	+6.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	4.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V_L	-	4.5K	V_{RMS}	(1), (2)
Lamp Current	I_L	TBD	7.0	mA_{RMS}	(1), (2)
Lamp Frequency	F_L	TBD	80	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

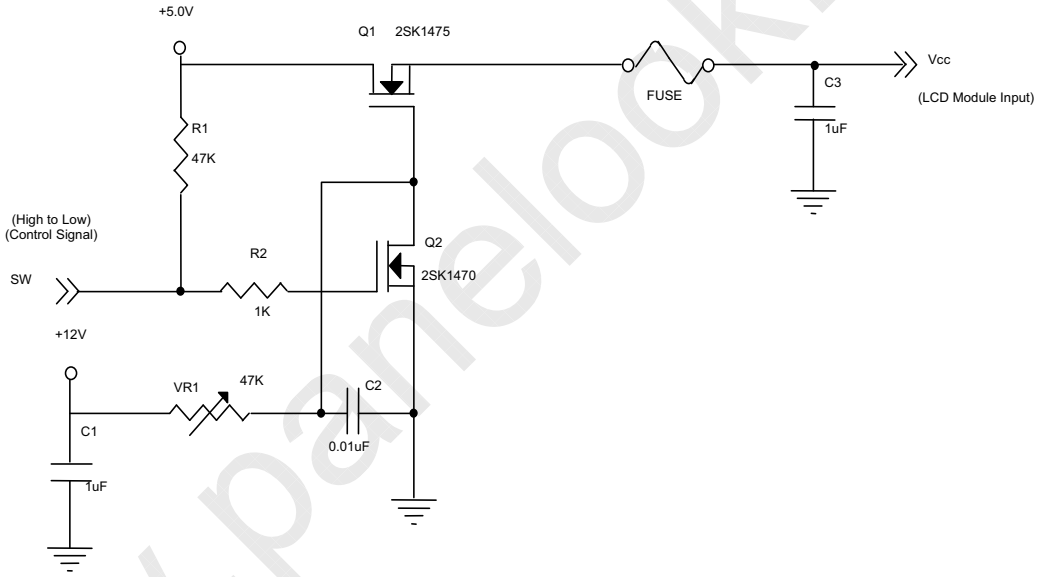
3.1 TFT LCD MODULE

Ta = 25 ± 2 ºC

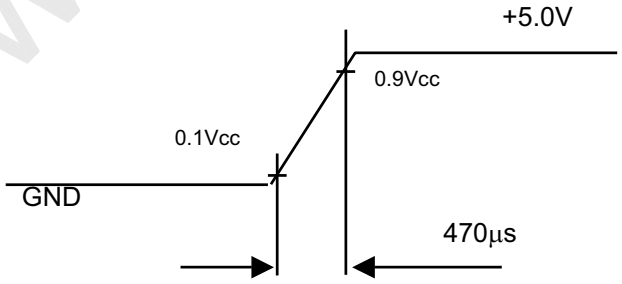
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	4.5	5.0	5.5	V	-
Ripple Voltage		V_{RP}	-	-	100	mV	-
Rush Current		I_{RUSH}	-	(2)	(4)	A	(2)
Power Supply Current	White	-		(1.8)	(2.2)	A	(3)a
	Black	-		(1.3)	(1.7)	A	(3)b
	Vertical Stripe	-		(1.7)	(2.1)	A	(3)c
LVDS differential input voltage		Vid	100	-	600	mV	
LVDS common input voltage		Vic	-	1.2	-	V	
Logic “L” input voltage		Vil	Vss	-	0.8	V	

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



Vcc rising time is 470μs



Note (3) The specified power supply current is under the conditions at Vcc = 5.0 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

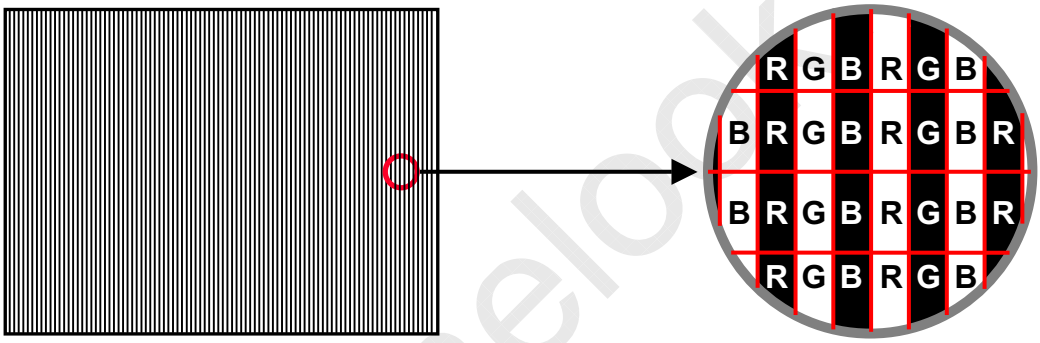
a. White Pattern

Active Area

b. Black Pattern

Active Area

c. Vertical Stripe Pattern



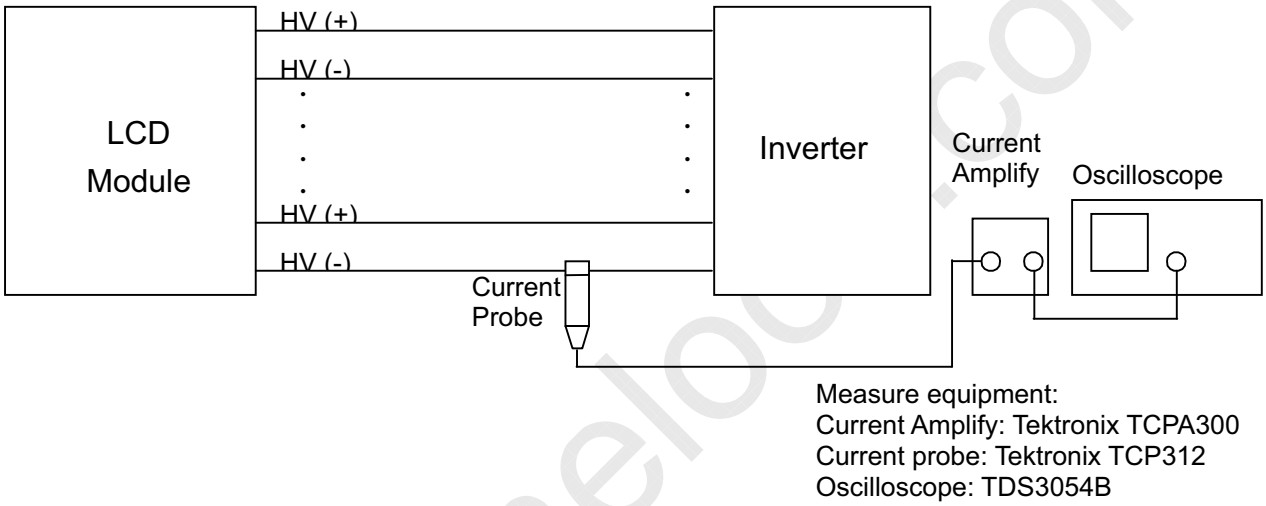
Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	TBD	(1980)	TBD	V_{RMS}	I_L = 6.0 mA
Lamp Current	I_L	TBD	(6.0)	TBD	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	---	---	(3670) (25 °C)	V_{RMS}	(2)
		---	---	(3900) (0 °C)	V_{RMS}	(2)
Operating Frequency	F_L	TBD	---	TBD	KHz	(3)
Lamp Life Time	L_{BL}	50,000	---	---	Hrs	(5)
Power Consumption	P_L	---	(71.28)	---	W	(4), I_L =6.0 mA

Note (1) Lamp current is measured by current amplify & oscilloscope as shown below:



Measure equipment:
Current Amplify: Tektronix TCPA300
Current probe: Tektronix TCP312
Oscilloscope: TDS3054B

Note (2) The voltage that must be larger than Vs should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note (3) The lamp frequency may produce interference with horizontal synchronization frequency from the display, which might cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronization frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L \times 6$

Note (5) The lifetime of lamp can be defined as the time in which it continues to operate under the condition Ta = 25 ±2 °C and I_L = 6.0 mArms until one of the following events occurs:

(a) When the brightness becomes or lower than 50% of its original value.

(b) When the effective ignition length becomes or lower than 80% of its original value. (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too

much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

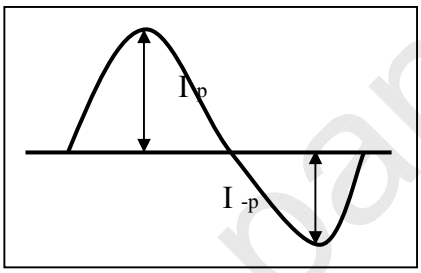
The output of the inverter must have symmetrical (negative and positive) voltage waveform and symmetrical current waveform.(Unsymmetrical ratio is less than 10%) Please do not use the inverter which has unsymmetrical voltage and unsymmetrical current and spike wave. Lamp frequency may produce interface with horizontal synchronous frequency and as a result this may cause beat on the display. Therefore lamp frequency shall be as away possible from the horizontal synchronous frequency and from its harmonics in order to prevent interference.

Requirements for a system inverter design, which is intended to have a better display performance, a better power efficiency and a more reliable lamp. It shall help increase the lamp lifetime and reduce its leakage current.

a. The asymmetry rate of the inverter waveform should be 10% below;

b. The distortion rate of the waveform should be within $\sqrt{2}$ ± 10%;

c. The ideal sine wave form shall be symmetric in positive and negative polarities



* Asymmetry rate:

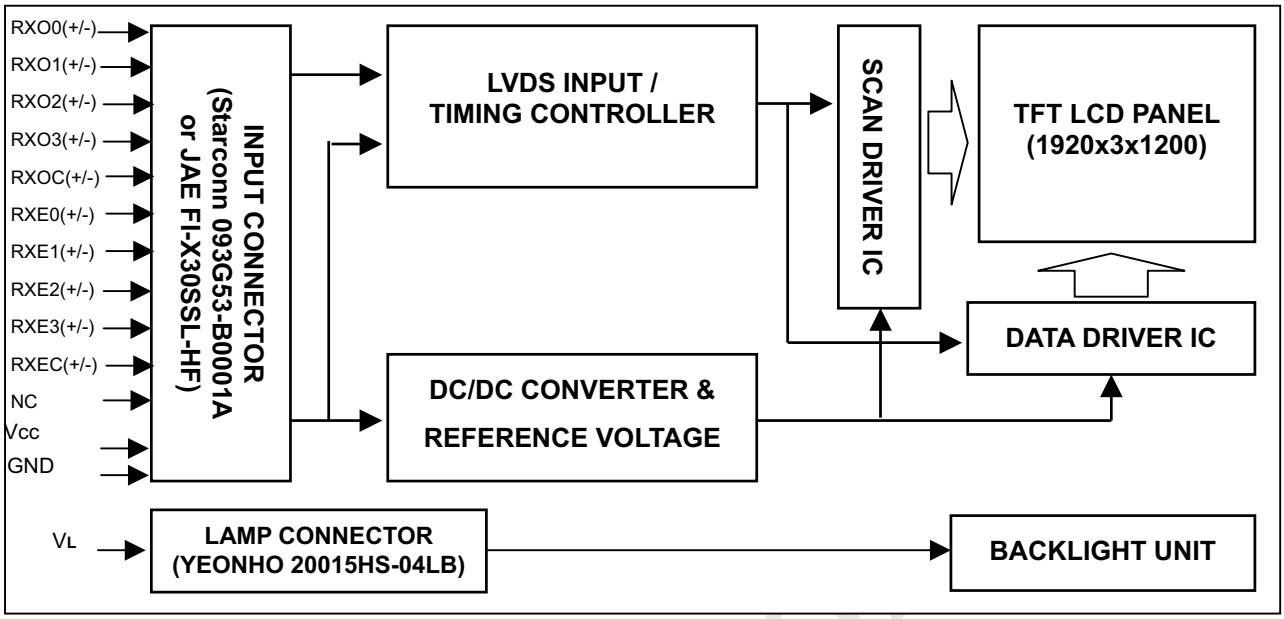
$| I_p - I_{-p} | / I_{rms} * 100\%$

* Distortion rate

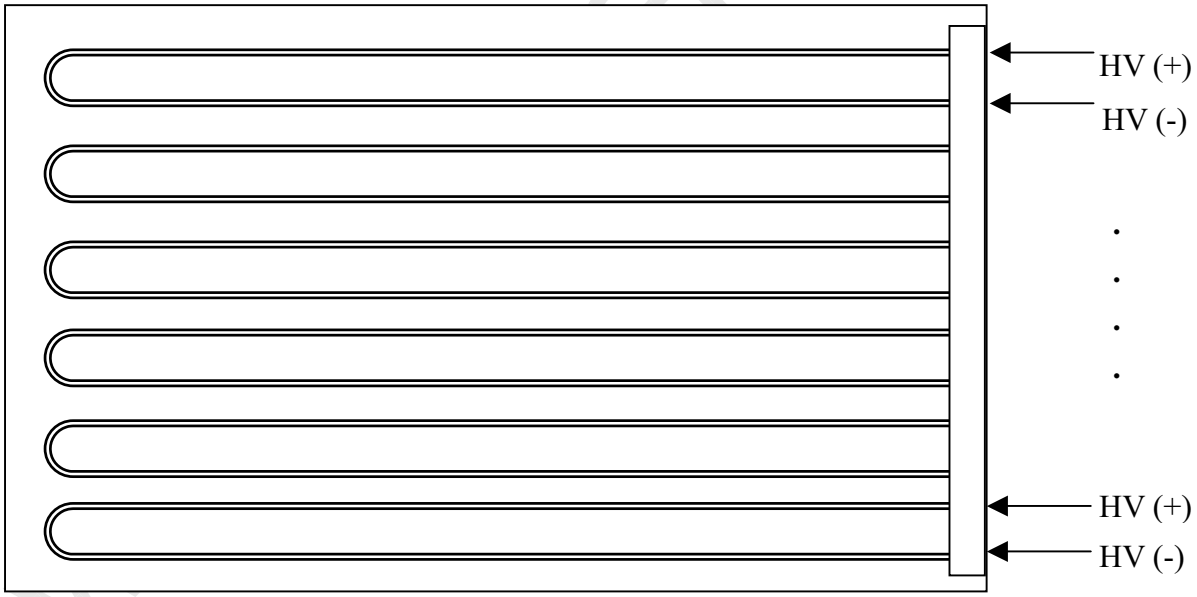
I_p (or I_{-p}) / I_{rms}

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Name	Description
1	RXO0-	Negative LVDS differential data input. Channel O0 (odd)
2	RXO0+	Positive LVDS differential data input. Channel O0 (odd)
3	RXO1-	Negative LVDS differential data input. Channel O1 (odd)
4	RXO1+	Positive LVDS differential data input. Channel O1 (odd)
5	RXO2-	Negative LVDS differential data input. Channel O2 (odd)
6	RXO2+	Positive LVDS differential data input. Channel O2 (odd)
7	GND	Ground
8	RXOC-	Negative LVDS differential clock input. (odd)
9	RXOC+	Positive LVDS differential clock input. (odd)
10	RXO3-	Negative LVDS differential data input. Channel O3(odd)
11	RXO3+	Positive LVDS differential data input. Channel O3 (odd)
12	RXE0-	Negative LVDS differential data input. Channel E0 (even)
13	RXE0+	Positive LVDS differential data input. Channel E0 (even)
14	GND	Ground
15	RXE1-	Negative LVDS differential data input. Channel E1 (even)
16	RXE1+	Positive LVDS differential data input. Channel E1 (even)
17	GND	Ground
18	RXE2-	Negative LVDS differential data input. Channel E2 (even)
19	RXE2+	Positive LVDS differential data input. Channel E2 (even)
20	RXEC-	Negative LVDS differential clock input. (even)
21	RXEC+	Positive LVDS differential clock input. (even)
22	RXE3-	Negative LVDS differential data input. Channel E3 (even)
23	RXE3+	Positive LVDS differential data input. Channel E3 (even)
24	GND	Ground
25	NC	No connection
26	NC	Not connection.
27	VCC	+5.0V power supply
28	VCC	+5.0V power supply
29	VCC	+5.0V power supply
30	VCC	+5.0V power supply

Note (1) Connector Part No.: Starconn 093G53-B0001A or JAE FI-X30SSL-HF.

Note (2) The first pixel is odd.

Note (3) Input signal of even and odd clock should be the same timing.

SELLVDS = Low or Open								
LVDS Channel E0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	EG0	ER5	ER4	ER3	ER2	ER1	ER0
LVDS Channel E1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	EB1	EB0	EG5	EG4	EG3	EG2	EG1
LVDS Channel E2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	EB5	EB4	EB3	EB2
LVDS Channel E3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	EB7	EB6	EG7	EG6	ER7	ER6
LVDS Channel O0	LVDS output	D7	D6	D4	D3	D2	D1	D0
	Data order	OG0	OR5	OR4	OR3	OR2	OR1	OR0
LVDS Channel O1	LVDS output	D18	D15	D14	D13	D12	D9	D8
	Data order	OB1	OB0	OG5	OG4	OG3	OG2	OG1
LVDS Channel O2	LVDS output	D26	D25	D24	D22	D21	D20	D19
	Data order	DE	NA	NA	OB5	OB4	OB3	OB2
LVDS Channel O3	LVDS output	D23	D17	D16	D11	D10	D5	D27
	Data order	NA	OB7	OB6	OG7	OG6	OR7	OR6

5.2 BACKLIGHT UNIT:

Pin	Symbol	Description	Remark
1-1	HV	High Voltage	Pink
1-2	HV	High Voltage	White
2-3	HV	High Voltage	Pink
2-4	HV	High Voltage	White
3-5	HV	High Voltage	Pink
3-6	HV	High Voltage	White
4-7	HV	High Voltage	Pink
4-8	HV	High Voltage	White
5-9	HV	High Voltage	Pink
5-10	HV	High Voltage	White
6-11	HV	High Voltage	Pink
6-12	HV	High Voltage	White

Note (1) Connector Part No.: 20015HS-04LB (YEONHO) or equivalent

5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. INVERTER SPECIFICATIONS

6.1 CONNECTOR TYPE

Items	Input connector type	Output connector type
CN1	YEONHO 20022WR-14L	YEONHO 20022HS-14L
CN2	ACES 88260-02001-06	ACES 87214-0200
CAN-CNE	YEONHO 20015HS-04LB	YEONHO 20015WR-07B

6.2 INPUT CONNECTOR PIN ASSIGNMENT

CN1 : YEONHO 20022WR-14L

No.	Signal	Feature
1	V_{BL}	+24 V
2		
3		
4		
5		
6	GND	GND
7		
8		
9		
10		
11	SOS	Shutdown Protection Signal
12	BLON	BL ON/OFF
13	ADIM	Analog Mode Dimming
14	SCAN ON/OFF	SCAN BL ON/OFF

CN2 : ACES 88260-02001-06

No.	Signal	Feature
1	STV	STV Signal Input
2	GND	GND

6.3 OUTPUT CONNECTOR PIN ASSIGNMENT

CNA-CNE : YEONHO 20015WR-07B

No.	Signal	Feature
1	CFL HOT	CFL High Voltage
2	CFL HOT	CFL High Voltage

6.4 GENERAL ELECTRICAL SPECIFICATIONS

6.4.1 ABSOLUTE MAXIMUM RATING

NO.	ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE(1)
1	INPUT VOLTAGE	V_{IN}	-	0	-	28	V	
2	SHUTDOWN PROTECTION SIGNAL	SOS	-	-0.5	-	6.5	V	
3	ON/OFF CONTROL VOLTAGE	V_{BLON}	-					
4	ANALOG DIMMING VOLTAGE	V_{ADIM}	-					
5	SCAN MODE ON/OFF CONTROL VOLTAGE	V_{SCAN}	-					
6	STV SIGNAL	V_{STV}	-					
7	OPERATING TEMPERATURE	T_{OP}	5~90% RH	0	-	75	°C	Protect inverters from moisture condensation and freezing. (Note 1)
8	STORAGE TEMPERATURE	T_{ST}	5~95% RH	-30	-	80	°C	

Note: The absolute maximum rating that a rated value must not be exceeded during operation. When it is used exceeding the maximum rating, for a certain reason, a possibility that an inverter may be damaged also recommends being used fully in operating condition as below.

6.4.2 OPERATING CONDITION

NO.	ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE(1)
1	POWER CONSUMPTION	P_{BL}	Normal mode	-	TBD	-	W	
2	INPUT VOLTAGE	V_{BL}	-	21.6	24	26.4	V	
3	INPUT CURRENT	I_{IN}	-	-	TBD	5.5	A	
4	SHUTDOWN PROTECTION SIGNAL	SOS	Normal	-	TBD	-	V	
			Abnormal	-	TBD	-	V	
5	ON/OFF CONTROL VOLTAGE	V_{BLON}	V_{BLON}=ON	2.5	-	3.3	V	
			V_{BLON}=OFF	0	-	0.8	V	
6	ANALOG DIMMING VOLTAGE	V_{ADIM}	Max.	-	5.0	-	V	
			Min.	-	0	-	V	
7	SCAN MODE ON/OFF CONTROL VOLTAGE	V_{SCAN}	V_{SCAN}=H	2.5	-	5	V	
			V_{SCAN}=L	0	-	0.8	V	
8	STV SIGNAL	T_{STV}	V_{SYN}=H	2.5	-	5	V	
			V_{SYN}=L	0	-	0.8	V	
9	OPERATING TEMPERATURE	T_{OP}	20～95% RH	0	-	60	°C	Protect inverters from moisture condensation and freezing. (Note 1)
10	STORAGE TEMPERATURE	T_{ST}	5～95% RH	-20	-	75	°C	

Note 1 Temperature and relative humidity condition are as below.

(a) 90 %RH Max. (Ta ≦ 40 ºC)

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation of water.

6.4.3 INITIAL CHARACTERISTICS (Ta = 25 ± 5 °C)

NO.	ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
1	INPUT VOLTAGE	V_{BL}	-	21.6	24	26.4	V	
2	INPUT CURRENT	I_{BL}	Normal Mode	TBD	TBD	5.5	A	
3	INPUT INRUSH CURRENT	-	V_{BL}=24 V	-	-	6	A_{peak}	
4	INPUT VOLTAGE RIPPLE NOISE	-	V_{BL}=21.6 V	-	-	TBD	mV_{P-P}	(Note 3)
5	INDIVIDUAL LAMP CURRENT	I_L	Normal Mode	5.5	6.0	6.5	mA	
6	SCAN MODE INDIVIDUAL LAMP CURRENT	I_L	Scan Mode	-	15	-	mA	
7	OSCILLATING FREQUENCY	F_W	-	50	65	70	KHz	
8	BURST MODE FREQUENCY	F_B		-	180	-	Hz	
9	OPEN LAMP VOLTAGE	V_S	Ta=0 °C	3900	-	TBD	V_{rms}	
			Ta=25 °C	3670	-	TBD	V_{rms}	
10	LAMP VOLTAGE	V_W	Ta=25 °C	TBD	1900	TBD	V_{rms}	
11	RISING TIME	T_{RISE}	-	-	-	500	μs	See Fig. 1, (Note 4)
12	FALLING TIME	T_{FALL}	-	-	-	500	μs	
13	ASYMMETRY RATIO	I_{DC}%	-	-	-	TBD	%	I_L (Note 6)| I_{peak} – I_{-peak} | /
14	RIPPLE NOISE RATIO	I_{ripple}%	-	-	-	TBD	%	I_{ripple}%= 2 * (I_{peak}- I_{valley}) / (I_{peak} + I_{valley}) * 100%
15	CREST FACTOR	CF	-	-	-	TBD	-	I_{peak} / I_L (Note 5)
16	START-UP TIME	T_S	≧0.9*I_L	1	-	2	Sec.	Power on to I_L stabilize period
17	TOTAL EFFICIENCY	η	-	80	-	-	%	P_{BL} / P_L, (Load: CCFL)
18	ACOUSTIC NOISE	Na	-	-	-	TBD	dBA	1m away from unit. (∥, ⊥) with cover.
19	DIFFERENTIAL TEMPERTURE	△T	Ta=25 °C	-	-	TBD	°C	(Note 6)
			Ta=70 °C	-	-	TBD	°C	

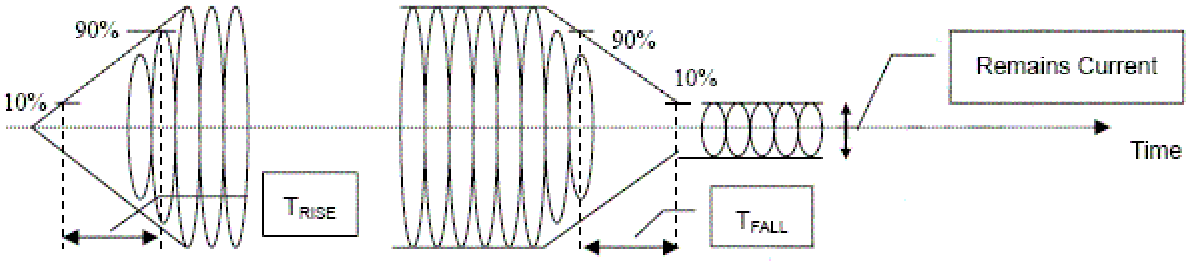
Note 2 Lamp for measurement, use back light: 24”back light unit. The measurement result is a result after 30 minutes of lighting.

Note 3 The 0.1uf ceramic cap and 1000uf aluminum cap should parallel between the input onnector whenever to evaluate all electrical characteristics.

Note 4 The definitions of rising time, falling time and remains current are based on high side lamp current and diagramed as Fig.1.

Note 5 I peak is the positive peak value of IL waveform, and I –peak is the negative peak value.

Note 6: This is inhibited in case of particular component working temperature exceeds its own hermal limit.



6.4.4 PROTECTION CHARACTERISTICS

NO.	ITEM	TEST CONDITION	RESPONDENCE OF SUBJECT	NOTE
1	OPEN LAMP PROTECTION (OLP)	-	Shutdown	1S<Tfault<2S (Note 7~10)
2	OUTPUT SHORT PROTECTION (OSP)	Output Shutter: 2 KΩ	Shutdown or I_{short} (peak value)≦ 2.8*I_{rms}	
3	INPUT OVER VOLTAGE PROTECTION (IOP)	≧1.25*Vin (typ)	Shutdown	
4	INPUT UNDER VOLTAGE PROTECTION (IUP)	≦0.8*Vin (typ)	Shutdown	

Note 7 Tfault is the duration since inverter ignition till shutdown by protection circuit is triggered.

Note 8 Any output short outside inverter should be protected.

Note 9 Whatever the above items occurred before inverter turn on or under inverter operating duration that inverter should be protected.

Note 10 When OLP & OSP protections have been trigged, inverter shall be restarted by input power source and V_{BLON} signal.

6.4.5 INTERFACE CHARACTERISTICS

NO.	ITEM		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE(11-12)
1	ON/OFF CONTROL VOLTAGE	ON	V_{BLON}	-	2.5	-	3.3	V	
		OFF		-	0	-	0.8	V	
2	ANALOG DIMMING VOLTAGE	MAX	V_{ADIM}	-	-	-	5	V	Minimum Duty
		MIN		-	-	0	-	V	Maximum Duty
3	SCAN MODE CONTROL VOLTAGE	ON	V_{SCAN}	-	2.5	-	5	V	
		OFF		-	0	-	0.8	V	
4	STV SINGLE VOLTAGE	HI	V_{STV}	-	2.5	-	5.0	V	Ext. Dim. Control
		LO		-	0	-	0.8	V	Int. Dim. Control

Note 11 Even if control signal over range in any conditions that there must no smell, smoke, and fire cause by any failure on inverter PCB or components.

Note 12 All the interface circuits without spike suppress component hence the hot plug in or plug out of all connectors are inhibited.

6.4.6 BACKLIGHT OPERATING MODE

ITEM	SCAN MODE	NORMAL MODE (VADIM INPUT)
VSCAN	HI	LO
VADIM	YES	YES
VSTV	YES	YES

7. INTERFACE TIMING

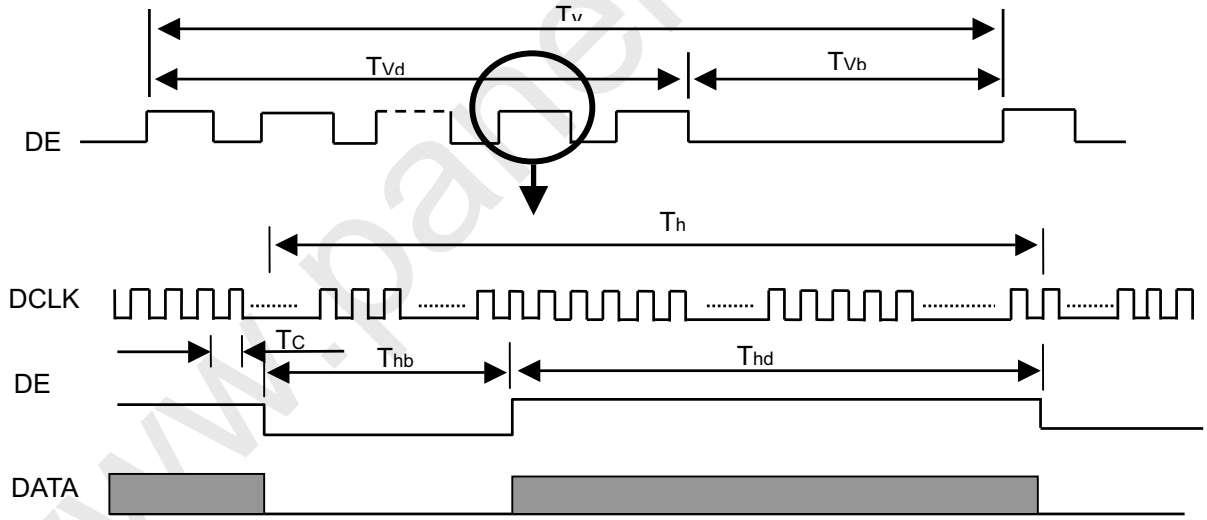
7.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	(50.0)	77	(83.0)	MHz	-
	Period	Tc	-	13.0	-	ns	
	High Time	Tch	-	4/7	-	Tc	-
	Low Time	Tcl	-	3/7	-	Tc	-
LVDS Data	Setup Time	Tlvs	600	-	-	ps	-
	Hold Time	Tlvh	600	-	-	ps	-
Vertical Active Display Term	Frame Rate	Fr	(40)	60	(63)	Hz	Tv=Tvd+Tvb
	Total	Tv	(1209)	1235	(1245)	Th	-
	Display	Tvd	1200	1200	1200	Th	-
	Blank	Tvb	(9)	35	Tv-Tvd	Th	-
Horizontal Active Display Term	Total	Th	(1030)	1040	(1075)	Tc	Th=Thd+Thb
	Display	Thd	960	960	960	Tc	-
	Blank	Thb	(70)	80	Th-Thd	Tc	-

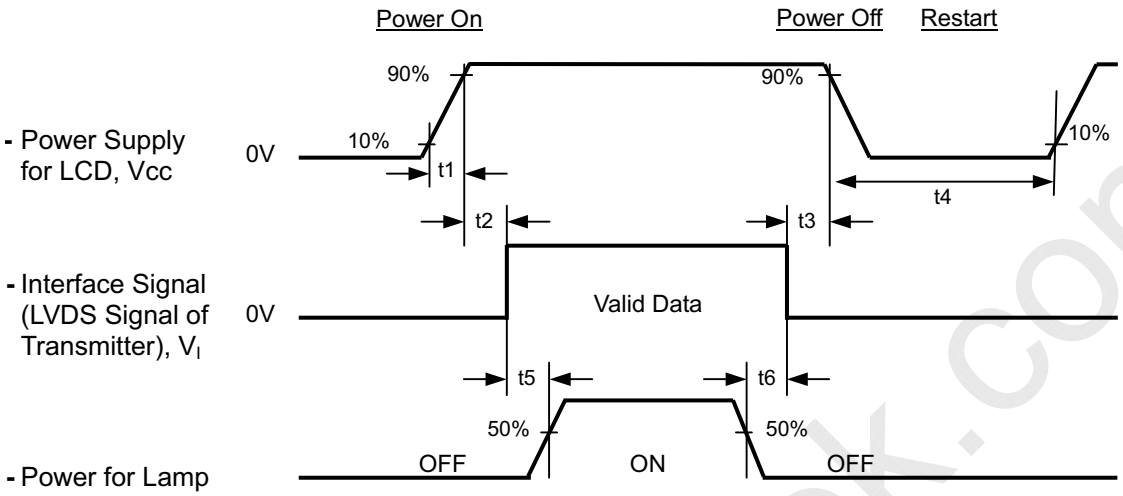
Note: Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM



7.2 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



Timing Specifications:

0.5< t1 ≦ 10 msec

0 < t2 ≦ 50 msec

0 < t3 ≦ 50 msec

t4 ≧ 500 msec

t5 ≧ 500 msec

t6 ≧ 90 msec

8. OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

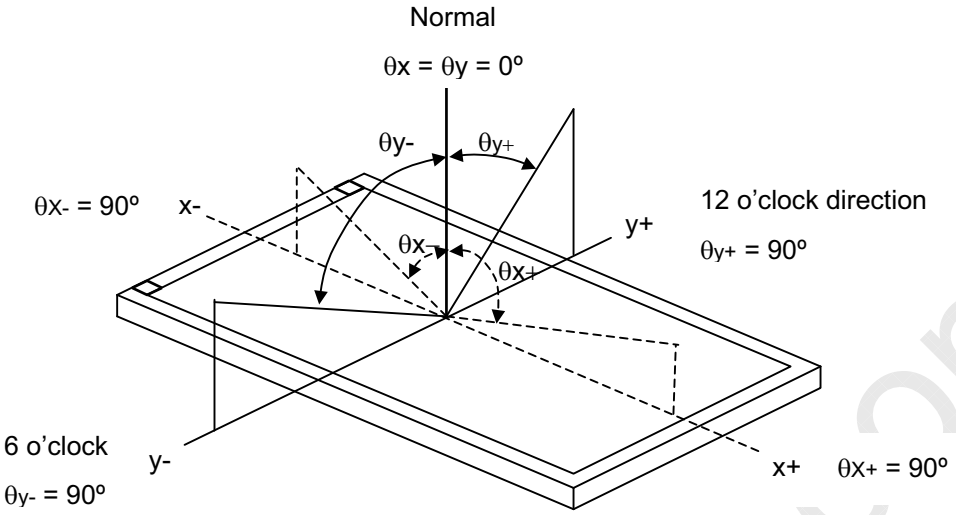
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	5.0	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Lamp Current	I_L	(6.0)	mA
Inverter Operating Frequency	F_L	50	KHz
Inverter	DARFON VK88070F02		

8.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (5).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	Rx	θ_x=0°, θ_Y =0° CS-1000T	Typ - 0.03	(0.645)	Typ + 0.03	-	(1), (5)
		Ry			(0.348)			
	Green	Gx			(0.288)			
		Gy			(0.603)			
	Blue	Bx			(0.142)			
		By			(0.076)			
	White	Wx			(0.313)			
		Wy			(0.329)			
Center Luminance of White (Center of Screen)		L_C		(400)	(500)	-	cd/m^2	(4), (5)
Contrast Ratio		CR		(700)	(1000)	-	-	(2), (5)
Response Time		T_R	θ_x=0°, θ_Y =0°	-	(13.5)	-	ms	(3), (7)
		T_F		-	(6.5)	-		
		$T_{GtG\ AVE}$		-	(8)	-		
White Variation		δW	θ_x=0°, θ_Y =0° CA-210	-	(1.25)	(1.40)	-	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR ≧ 10 CA-210	(80)	(88)	-	Deg.	(1), (5)
		θ_x-		(80)	(88)	-		
	Vertical	θ_Y+		(80)	(88)	-		
		θ_Y-		(80)	(88)	-		

Note (1) Definition of Viewing Angle (θx, θy):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L255 / L0

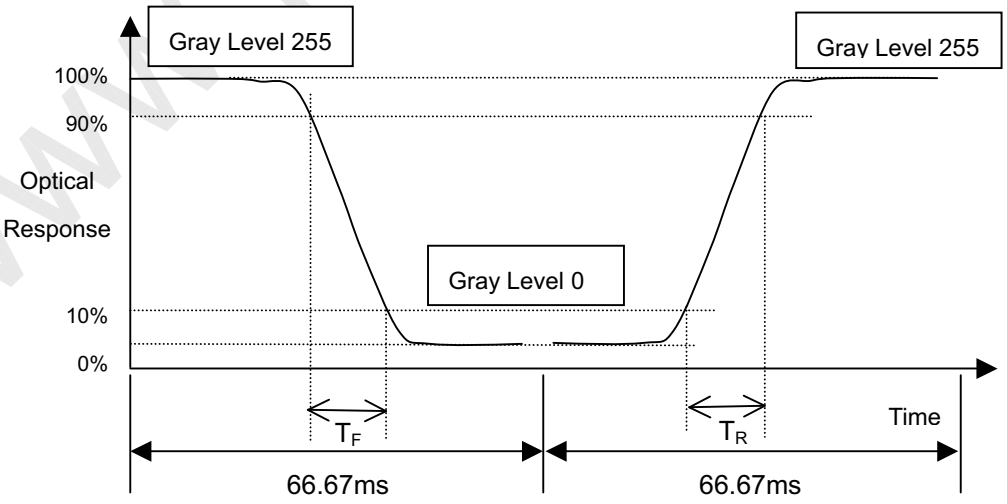
L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Luminance of White (L_C):

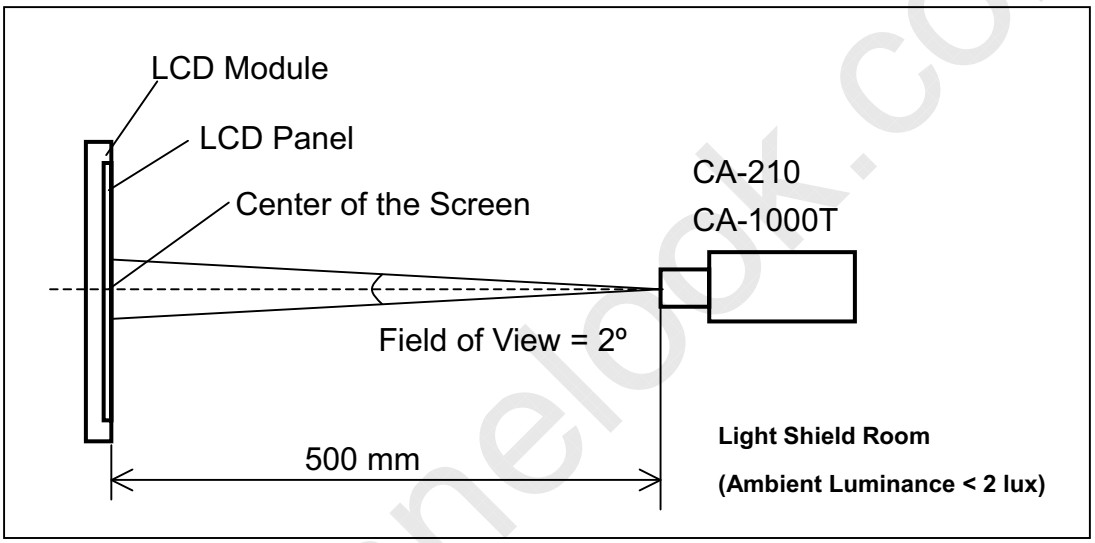
Measure the luminance of gray level 255 at center point

L_C = L (1)

L (x) is corresponding to the luminance of the point X at Figure in Note (6).

Note (5) Measurement Setup:

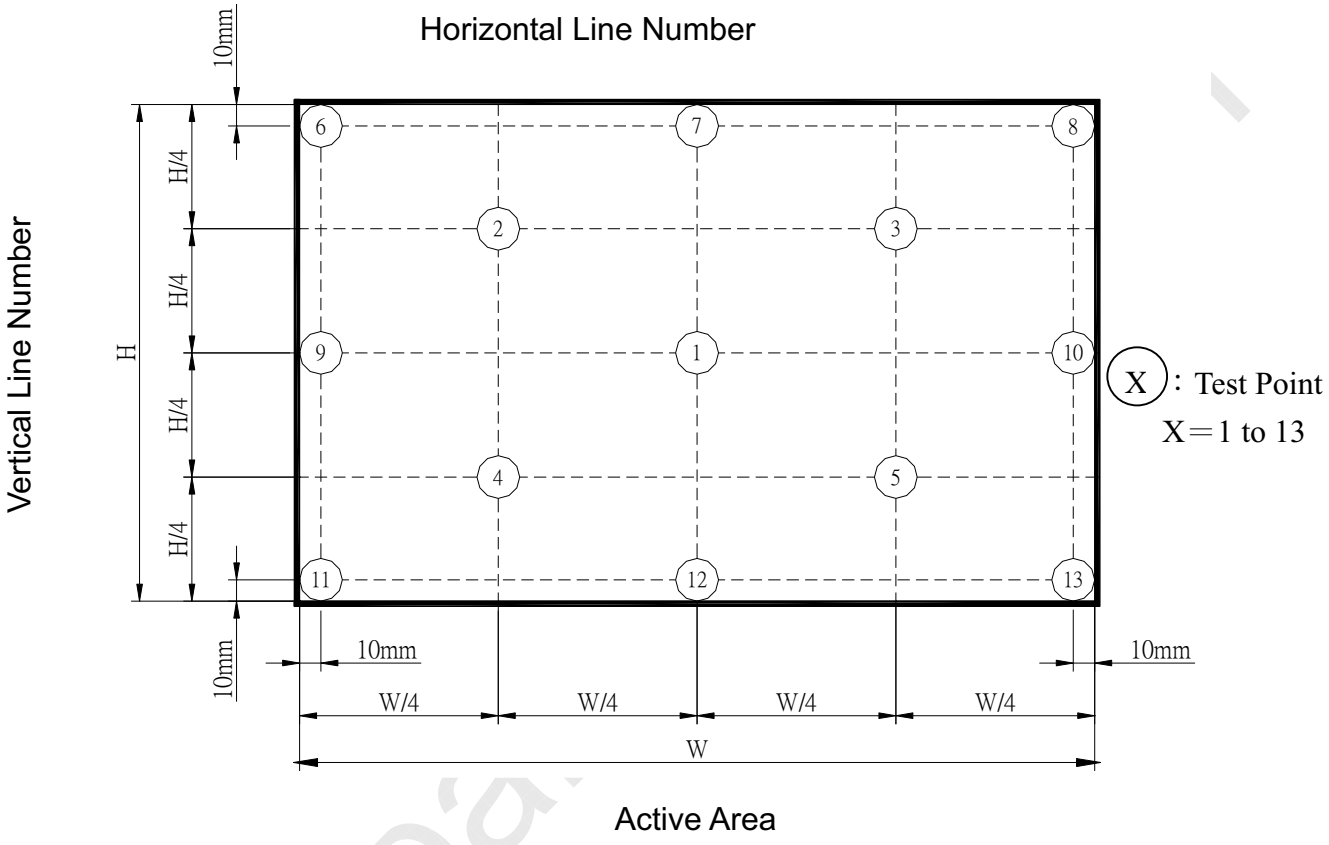
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 13 points

$$\delta W = \frac{\text{Maximum [L(1), L(2), L(3), L(4), L(5), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}{\text{Minimum [L(1), L(2), L(3), L(4), L(5), L(6), L(7), L(8), L(9), L(10), L(11), L(12), L(13)]}}$$



Note (7) Definition of Response Time (T_{GTG_AVE}):

T_{GTG_AVE} is defined as the total average response time for "Gray To Gray ".

The Gray to Gray response time is defined as the following chart.

Gray to Gray		Target Gray								
		G0	G32	G64	G96	G128	G160	G192	G224	G255
Initial Gray	G0									
	G32									
	G64									
	G96									
	G128									
	G160									
	G192									
	G224									
	G255									

9. PACKAGING

9.1 PACKING SPECIFICATIONS

(1) 5 LCD modules / 1 Box

(2) Box dimensions: 645(L) X 377(W) X 470(H) mm

(3) Weight: approximately 16.5Kg (5 modules per box)

9.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation

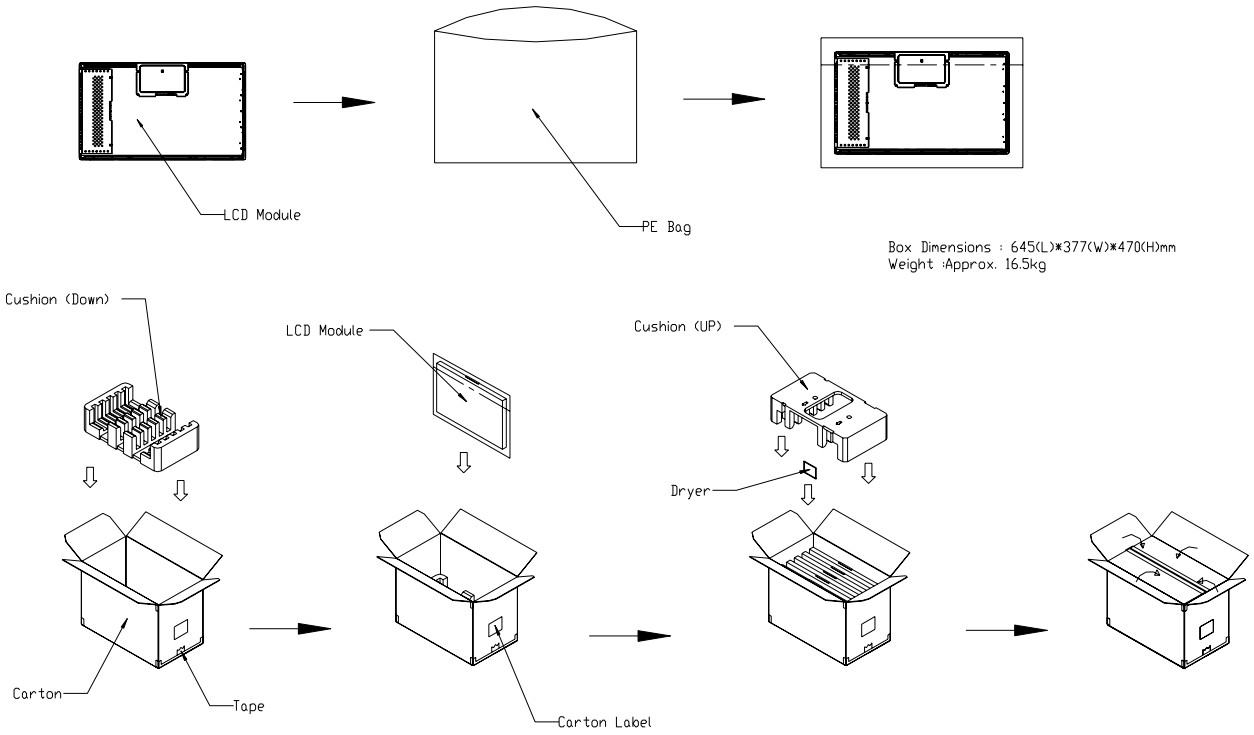


Figure. 9-1 Packing method

For ocean shipping

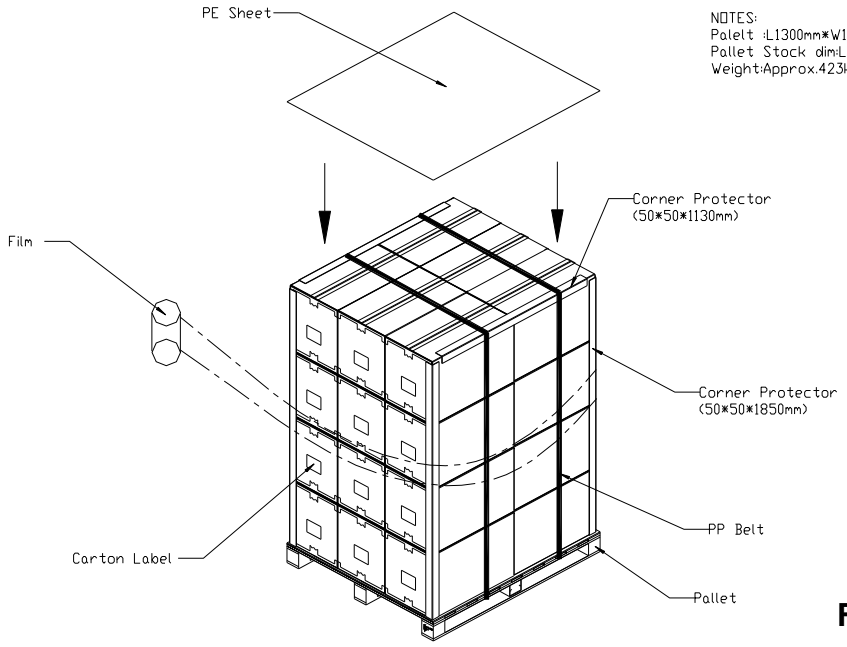


Figure. 9-2 Packing method

For air transport

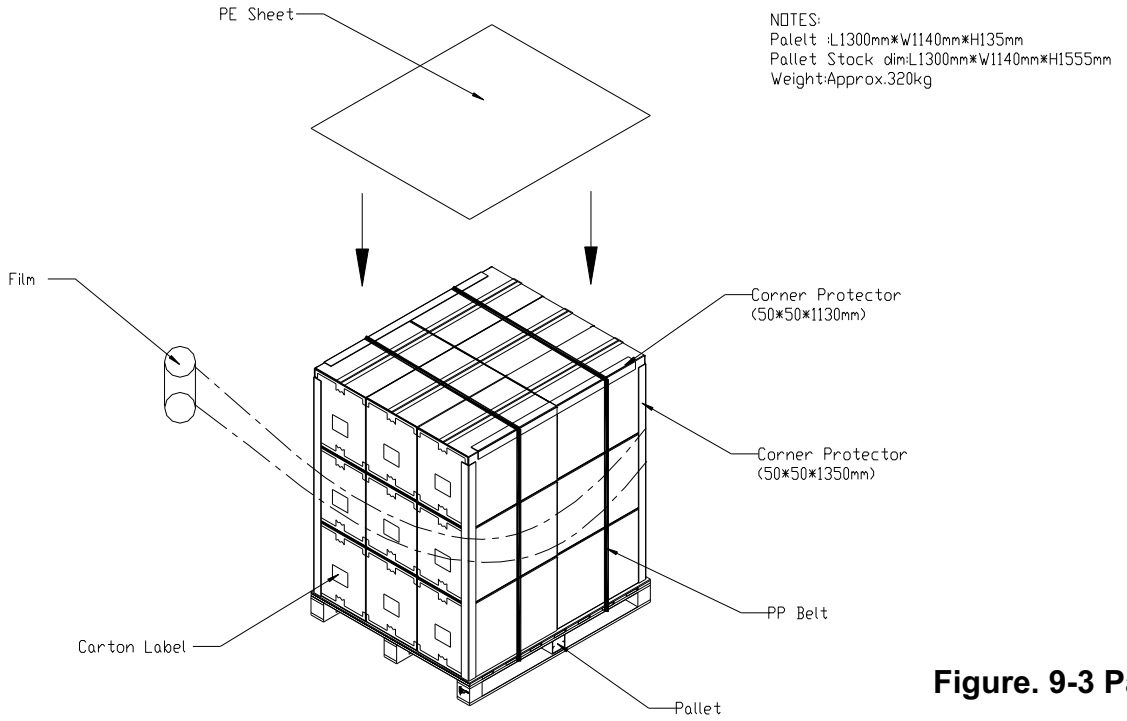


Figure. 9-3 Packing method

10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: M240J1-L03

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

Code	Meaning	Description
XX	CMO internal use	-
XX	Revision	Cover all the change
X	CMO internal use	-
XX	CMO internal use	-
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U.
L	Product line #	Line 1=1, Line 2=2, Line 3=3, …
NNNN	Serial number	Manufacturing sequence of product

(d) Customer's barcode definition:

Serial ID: CM-24J13-X-X-X-XX-L-XX-L-YMD-NNNN

Code	Meaning	Description
CM	Supplier code	CMO=CM
24J13	Model number	M240J1-L03 = 24J13
X	Revision code	Non ZBD: 1,~,9,0 / ZBD: A~Z
X	Source driver IC code	Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M
X	Gate driver IC code	
XX	Cell location	Tainan Taiwan=TN, Ningbo China=CN
L	Cell line #	1~12=0~C
XX	Module location	Tainan Taiwan=TN, Ningbo China=CN
L	Module line #	1~12=0~C
YMD	Year, month, day	Year: 2001=1, 2002=2, 2003=3, 2004=4… Month: 1~12=1, 2, 3, ~, 9, A, B, C Day: 1~31=1, 2, 3, ~, 9, A, B, C, ~, T, U, V
NNNN	Serial number	By LCD supplier

11. PRECAUTIONS

11.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the module during assembly.

(2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will be damaged.

(4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

(5) Do not pull the I/F connector in or out while the module is operating.

(6) Do not disassemble the module.

(7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

(8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.

(9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

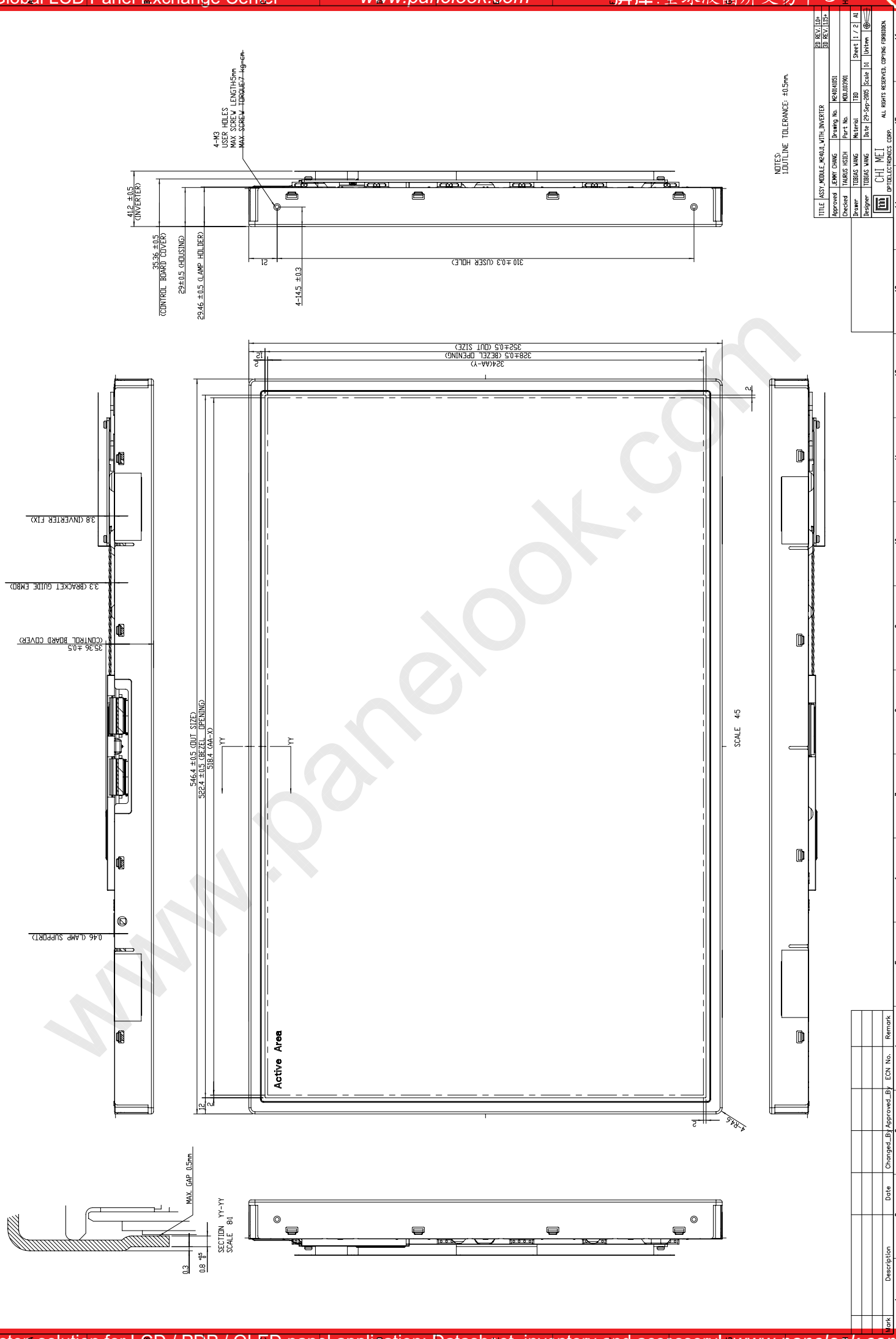
(10) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

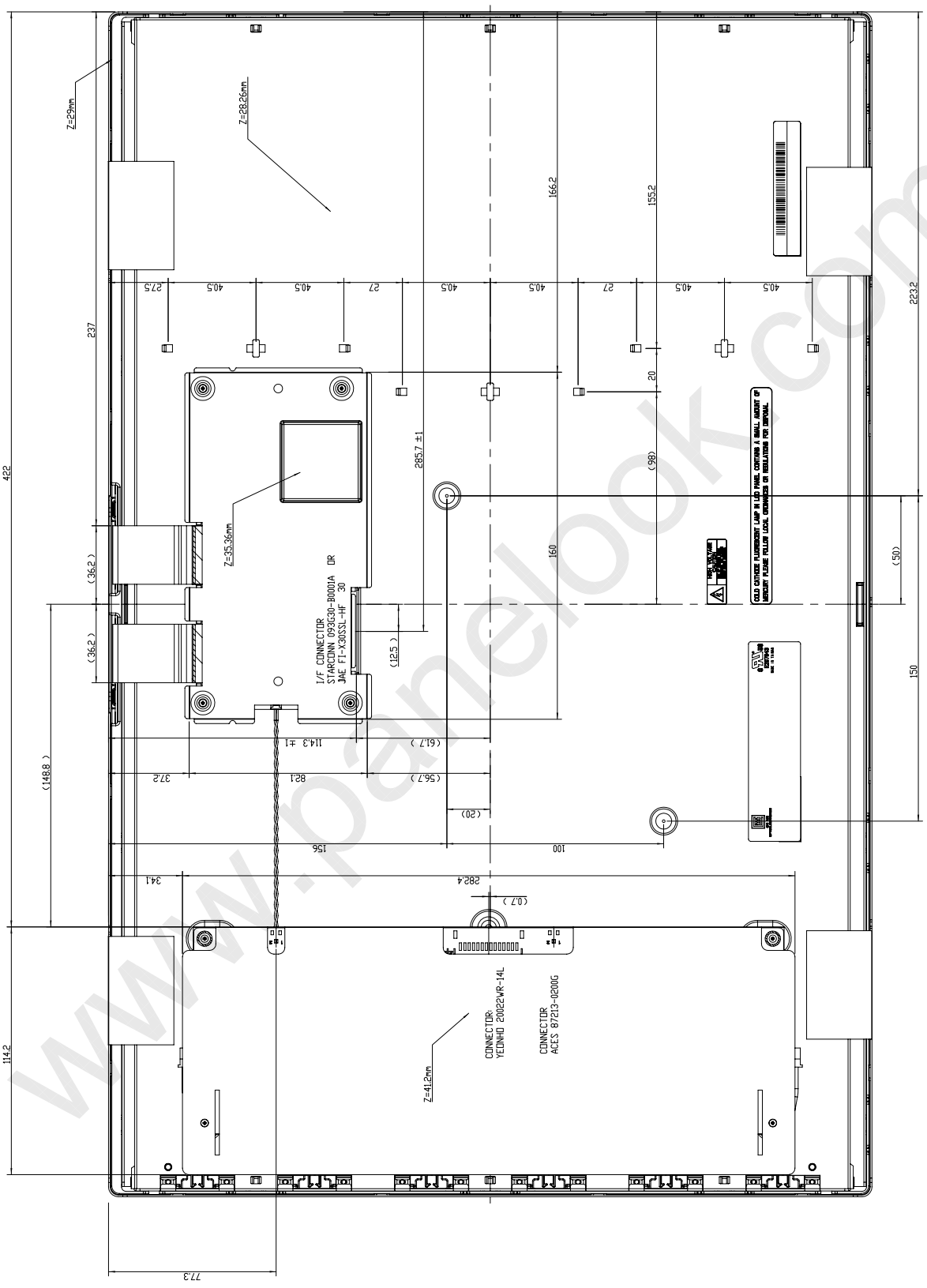
11.2 SAFETY PRECAUTIONS

(1) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

(2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(3) After the module's end of life, it is not harmful in case of normal operation and storage.





NOTES:
1.OUTLINE TOLERANCE: ±0.5mm.

SCALE 1:1

TITLE	ASSY_MODULE_M240J_WITH_INVERTER			P1 REV.110+			
Approved	JENNY CHANG	Drawing No.	M240J41051	D1 REV.115+			
Checked	THARUS HSIEH	Part No.	MOU.J003961			Sheet	2 / 2 A1
Drawer	TOBIAS WANG	Material	TBD	Scale	1/1	Unitmm	
Designer	TOBIAS WANG	Date	29-Sep-2005	CHI MEI OPTOELECTRONICS CORP.		ALL RIGHTS RESERVED, COPYING FORBIDDEN.	

Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark